FLIGHT
and The AIRCRAFT ENGINEER

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The Outlook

Cleaning Up

VERY great interest in the subject of escort fighters has been aroused by the article we published in our issue of January 11, judging from the correspondence received. Some of the letters are published this week; others were not intended for publication, but raised interesting problems. Of these, some are tactical, but some lead to the much broader question of cleaning up the aerodynamic design.

It appears quite probable that even our present single-seater fighters could be still further improved; not much, but probably enough to make the attempt worth while. Frequently the setting of the wings on the fuselage is critical, and there is reason to think that a slight reduction in the angle might reduce the body-wing interference drag. The shape and location of the pilot's windscreen, and the shape of the cockpit roof, are apt to be sensitive spots. One recollects that some years ago, when Boulton and Paul were making aeroplanes at Norwich, in the days before the present separate company was formed, they built a machine for commercial work, and the type of windscreen which the operating company asked for was found, from wind tunnel tests, to reduce the cruising speed by many miles per hour. How much more is this particular excrescence likely to offend on machines twice as fast?

But playing about with such minor items is in the nature of a palliative only. If we are to expect either startling increases in speed or a greatly extended range (for, of course, aerodynamic fineness can be used for either objective) something more will be required.

New Engine Arrangements

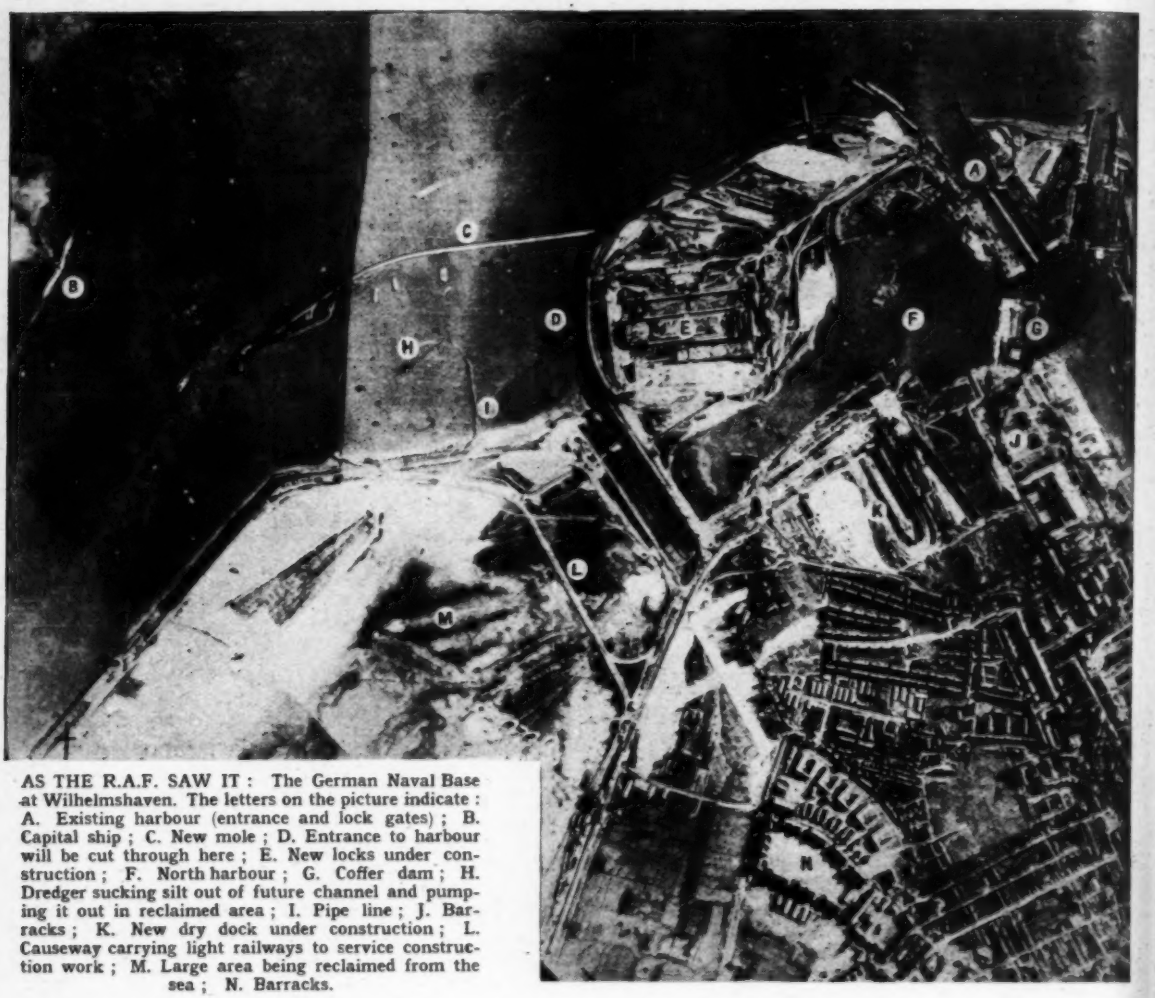
IN his speculative sketches of possible escort fighters Mr. King adhered to the orthodox two-engines-on-the-wings arrangement. Other arrangements are, however, possible and their advantages are not, of course, confined to, nor possibly even especially useful for, escort fighters. That engines on the wings add very greatly to the drag cannot be denied. Engines in tandem are attractive from the point of view of drag reduction, but a price has to be paid for the lower drag. This price takes the forms of extra weight and extra complication.

With engines placed in tandem, three alternatives appear possible. The engines may be made to drive two airscrews in opposite directions, as was done by that clever Italian engineer Castoldi in his Macchi design. That machine, be it noted, still holds the world's speed record. But it had to fly for a very short time only, carried no military load, and as it was to be used in ideal weather only, a high landing speed could be tolerated. On the other hand, it was built in the days before flaps were used, and so did not have that modern aid to high lift.

Another alternative is to place the engines themselves inside the fuselage, but to mount the airscrews outboard, ahead of the leading edge of the wing. This introduces the problem of shafting strong enough to transmit the high powers of the modern engines. The design of such shafting, however, is straightforward engineering and should not present great difficulties. The main question is one of weight, and one imagines that the weight of shafting and the necessary gears might well amount to something of the order of one pound per horse-power.

The reduction of drag which would result from such an arrangement (we visualise the shafts being buried in the wings, of course) would certainly be very great, but the extra weight involved would probably not be justifiable except for machines intended to have a fairly long range or an exceptionally high speed.

Still further drag reduction would attend the placing of the airscrews behind the wings. This is really a variant of the second way of using engines in tandem. The old argument against "pushers," that the fore-and-aft weight distribution would be upset, could probably be overcome by suitable placing of the engines in the fuselage. With airscrews behind the wing, however, the wheels would have to be well supplied with mudguards, otherwise there would be likely to be trouble with stones and dirt being thrown into the airscrews. And, of



AS THE R.A.F. SAW IT : The German Naval Base at Wilhelmshaven. The letters on the picture indicate : A. Existing harbour (entrance and lock gates) ; B. Capital ship ; C. New mole ; D. Entrance to harbour will be cut through here ; E. New locks under construction ; F. North harbour ; G. Coffer dam ; H. Dredger sucking silt out of future channel and pumping it out in reclaimed area ; I. Pipe line ; J. Barracks ; K. New dry dock under construction ; L. Causeway carrying light railways to service construction work ; M. Large area being reclaimed from the sea ; N. Barracks.

course, airscrews behind the wings would call for a taller undercarriage in order to give the necessary ground clearance. Unless a tricycle undercarriage were adopted, in which case a smaller ground angle would suffice.

In any case, there is a good deal to be said for the tricycle undercarriage, although it must be admitted that it, like all the other refinements, must inevitably add still more weight and complication.

There is plenty for our designers to think about, and to give them a hand it seems advisable to start experimental research at once on fundamental problems connected with the design, strength and weight of shafting. That seems to be a subject which the Royal Aircraft Establishment might well tackle.

Peace Hath Her Victories

CORSAIR is home again. Captain J. C. Kelly Rogers and crew are to be congratulated on what must be the greatest feat of aerial salvage ever attempted and successfully accomplished.

To land an Empire flying boat on a narrow, shallow stream in the heart of Africa without loss of life or cargo, only to be cheated out of a complete victory by a submerged rock, is a fine piece of work. But to take the same boat off in a coldly premeditated attempt, after first doing civil engineering work of some magnitude and with that knowledge of a previous failure, is a finer still.

We take off the editorial hat to the able and gallant captain and his crew, and to the no less able engineers whose imagination and toil under the hot sun enabled a very valuable boat to be brought home again. And to the authorities of the Belgian Congo, thanks are due for their willing international co-operation.

A German Speciality

GERMANY sets great store by her dive-bombers. In Spain and Poland these machines—chiefly two-seater Junkers Ju 87s and Henschel Hs 123 single-seaters—did work of indisputable value in destroying with heavy bombs small but important targets, and it may be expected that dive-bombing will play a big part in operations on the Western Front, though the Ju 87s will have insufficient range to operate against England unless bases are secured for them in the Low Countries. It is believed, however, that the fast twin-engined Ju 88 long-range aircraft is also stressed for dive-bombing, though at a comparatively shallow angle. Moreover, as pointed out in *Flight* last week, it is possible that the Messerschmitt Me 110 is fitted with air brakes with a view to its use for diving attacks on ground targets.

So, considering the importance attached to dive-bombing not only by the Germans but by the Italians, the article which appears in this issue on international practice in the design of suitable aircraft is of interest.

WAR in the AIR

Royal Air Force Photographs of German Bases : The Premier's Statement

WHILE the never-ending patrols around the coast of Great Britain and adjacent seas have been ceaselessly carried on, last week was singularly devoid of any spectacular or major actions. True it is that a scrap between two machines can be exciting enough to the crews involved, at the same time undue prominence must not be given to small skirmishes which will pale into insignificance if and when the air war really gets going.

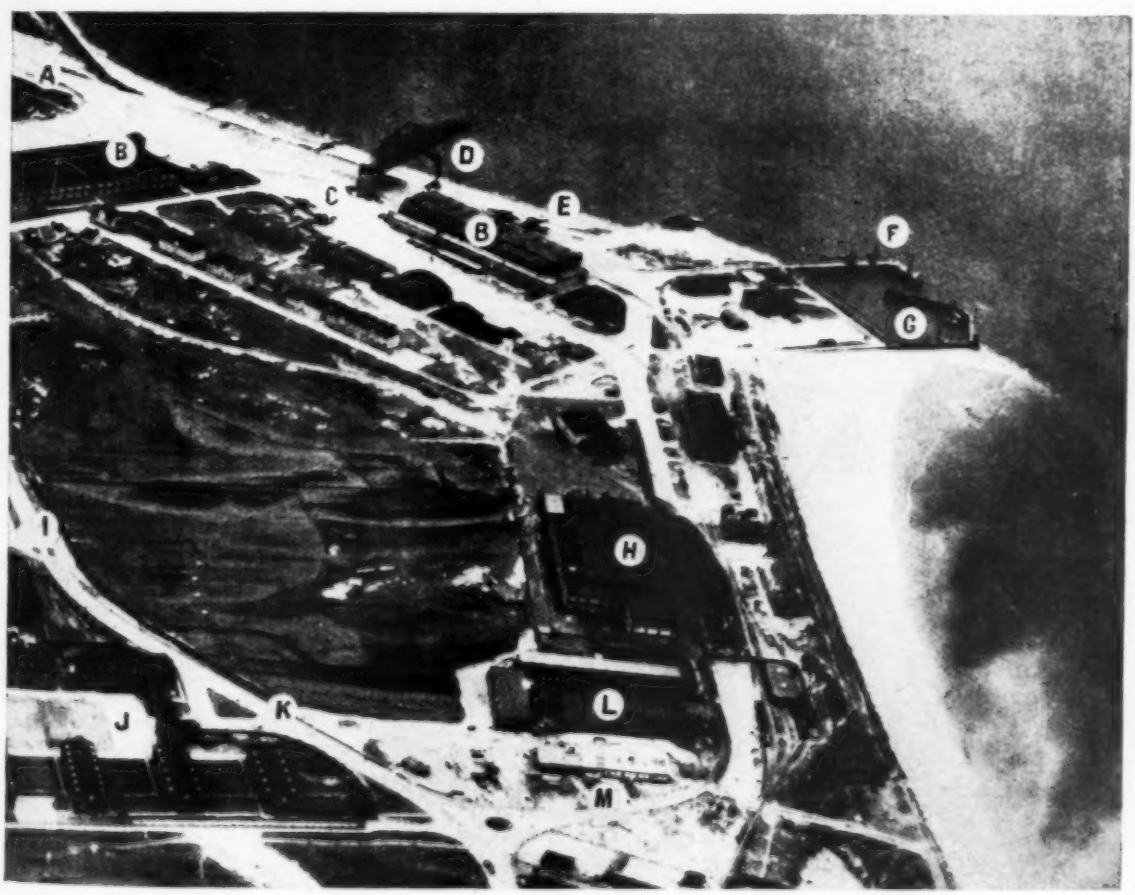
Some interesting figures and facts of the work of the Coastal Command have been made available. Since the outbreak of hostilities the landplanes and flying boats under its control have averaged over 1,000,000 miles per month! And this in winter flying, which more often than not involves either storm or fog at this time of the year. In their peregrinations Coastal Command have made over one hundred attacks on German submarines, and one station alone has a score of six undoubted U-boat sinkings.

* * *

ON January 16 Mr. Chamberlain gave the House of Commons his latest review of the war and stressed the inhumanity of the German attacks on unarmed and unescorted trawlers in the North Sea. Here is his statement in so far as the air war is concerned:—

"During the last month air activity has been hampered by short daylight, high winds, frost, fog and snow-covered landing places; yet our air forces have none the less been continuously in action, in particular over the whole battle area of the North Sea. (Cheers.) Every week considerable bomber forces have swept the Heligoland Bight and the approaches to the Baltic in search of such units of the German Fleet as might venture to put to sea. Reconnaissance has been regularly maintained deep into German territory, in part by aircraft based on this country, in part by those of the British Air Forces in France. This long-distance reconnaissance has now been extended to Eastern Germany, to Austria and to Bohemia.

"In the war at sea the lack of success attained by the U-boat campaign was followed by the indiscriminate and unnotified strewing of mines on the high seas, careless alike of the conventions of civilised warfare and of the consequences to innocent passengers and crews. It would not be in the public interest to say more on this subject



List on the Island of Sylt, is a big German seaplane base as shown by this photograph taken by R.A.F. reconnaissance aircraft. The machines in front of the hangars (C and E) are mostly Heinkel He 115 floatplanes, but there appears to be one Dornier Do 18 flying boat which has two Junkers Deisel engines in tandem. From this the R.A.F. has plotted the position of the wireless station (A), hangars (B and H), cranes (D and F), barracks (J), transport sheds (L) and buildings under construction (M).

WAR IN THE AIR (CONTINUED)

at present than that this latest threat is already coming under control, and that we have every confidence in being able presently to defeat it. (Cheers.)

"I have already informed the House of the introduction of the system of offensive patrols carried out by our aircraft over the operating bases of the German seaplanes. These patrols have been maintained throughout the hours of darkness on every night during which weather conditions would allow seaplanes to operate; bombs have been dropped whenever lights have been exposed to enable aircraft to take off from the water, and a rigid black-out has been enforced upon the enemy's bases. During the hours of daylight enemy aircraft have rarely ventured within reach of our fighter forces, and our patrols have repeatedly gone up to seek for aircraft, which turned back when encountered and evaded pursuit. Our reconnaissance patrols have, however, had frequent encounters with these wandering German aircraft out over the North Sea, and, though not themselves equipped as fighters, have invariably taken the offensive and have pressed it home by every means at their disposal.

Attacks on Coastal Craft

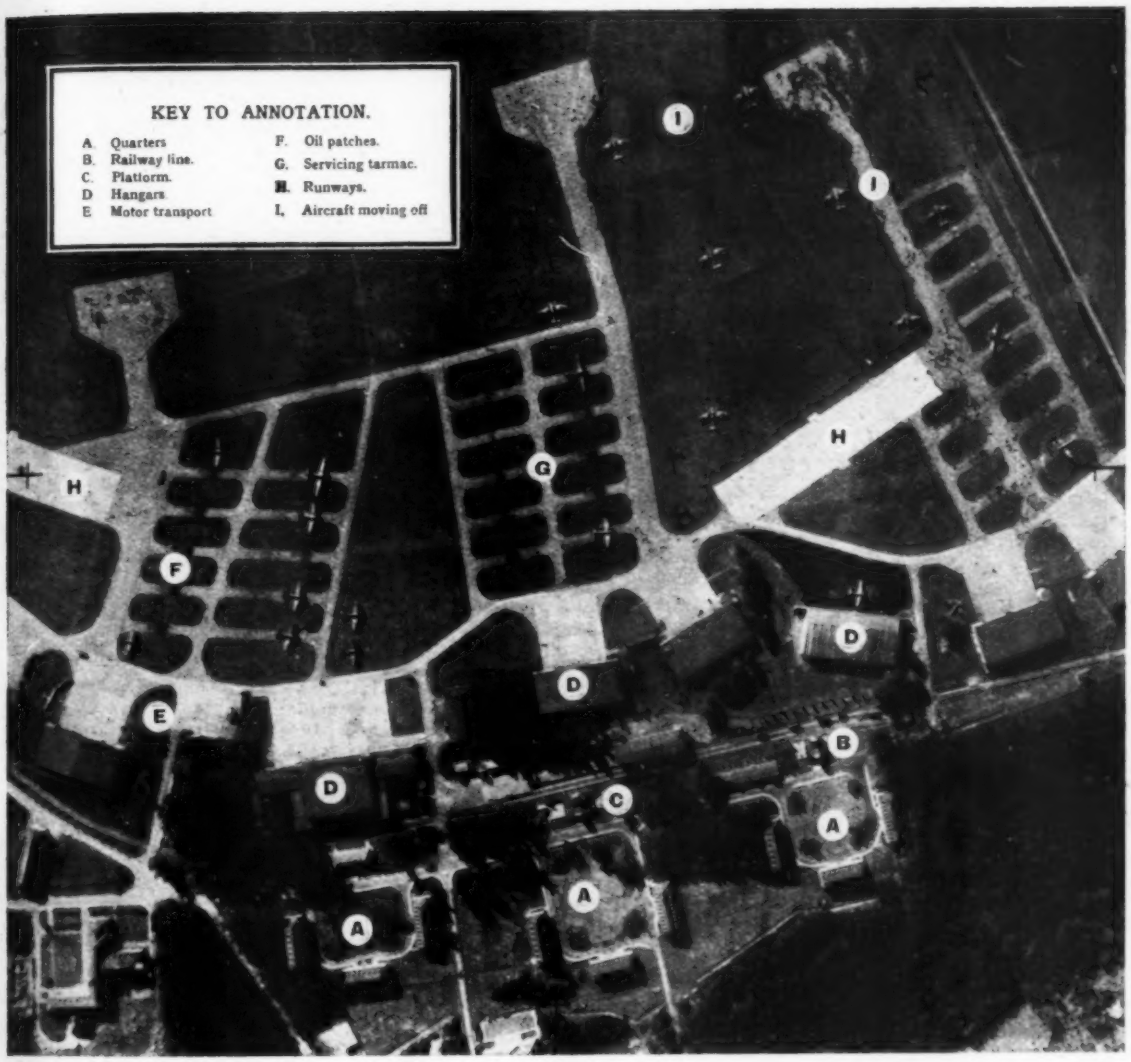
"IN the last few weeks we have been horrified by the calculated brutality involved in enemy attacks from the air on unarmed and unescorted trawlers. In December, 32 attacks of this nature were made and took the form of the bombing and machine-gunning of crews. Six trawlers were sunk and four damaged. Twenty-two escaped undamaged. During the present month there have been no fewer than 13 similar attacks from the air on unarmed trawlers. Two of these were sunk. A further outrage, wholly incompatible with the universally accepted principles of warfare between civilised peoples, was committed against a lightship and against a Trinity House tender carrying men on lightship relief. These are men whose lives are devoted to the service of their fellow-men of every nation, and who might claim to be immune from attack. (Cheers.) Yet they were brutally machine-gunned, two of them were killed and 32 were wounded by machine-gun bullets. It is significant that all these cowardly attacks were made in weather conditions which increased the difficulties of interception by our aircraft and that they died down as soon as improved conditions made it possible for our standing patrols to press home their pursuit.

"Agreement has been reached between the Governments of the United Kingdom, Canada, the Commonwealth of Australia and New Zealand on the details of the Empire Air Training Scheme, and there is now no obstacle to the development of that great enterprise. The House is, of course, aware of the extent to which pilots and other personnel from the Dominions are serving in the Air Forces here and the valiant exploits which they have already performed. (Cheers.) The training of both land and air forces in the Union of South Africa is being rapidly developed, and these forces are in a position to assist in African defence when the need arises."

Raiders—Old and New

THE 25th anniversary of the first German air raid on Great Britain occurred on January 19. Dr. Goebbels' henchmen did not consider the killing of three people by Zeppelin bombs on the east coast worthy of commemoration on a large scale so only sent over one Heinkel and this to the Aberdeen area. It was last seen with its

Missed! Now we'll have another go. A picture taken from a German aircraft as it turns to make a second attack on a ship in the North Sea.



Another of the remarkable reconnaissance photographs secured by the R.A.F. over Germany. This shows the aerodrome at Langen Haagen, ten miles north of Hanover. The great majority of the aircraft are Heinkel He 111Ks. Some are of the latest short-nosed design with straight-edged wings, but others are of the older type with a long nose and wings of elliptical form. On the original it is possible to identify two Junkers Ju 52 bomber transports.

undercarriage down and the rear gunner out of action. Times and aircraft have changed.

For the first time during the war French fighters have carried an air fight almost to the English coast before bringing down their adversary. The patrol was at a high altitude in the neighbourhood of Calais when a German machine was observed crossing the frontier. The battle began at 27,000ft. over the sea and a dog fight ensued during which height was gradually lost. Eventually the enemy fled towards the Continent with both oil and petrol leaking and the port engine stopped. After a desperate attempt to reach the coast it finally crashed while still a short way out to sea.

49 Deg. F. Below

THE news from Finland shows the lamentable lack of fighter aircraft available. Temperatures during the past week have been the lowest recorded for many years, eighty-one degrees of frost Fahrenheit being recorded at one time near Helsinki.

Bombing by the Russians, which appears to be indiscriminate so long as there is just something to be seen in the bomb or machine gun sights, has been much intensified. Each day raids in which U.S.S.R. machines totalling three hundred to five hundred take part, cover the whole country, but particular attention is paid to ports on the Baltic coast in an endeavour to stop imports, especially war material. Strangely enough the number of casualties does not seem high, presumably the houses are mostly equipped with cellars or good shelters have been dug. The density of housing is very low and most of the buildings are of wood, double walled. This would account for both the low casualty rate and the heavy destruction by fire.

It is known that aircraft are on the way to Finland but whether they will be in large enough quantity remains to be seen. In retaliation the Finns have bombed Russian bases at Kronstadt and Paldiski as well as others on the Estonian coast.

Remarkable Pictures

THE R.A.F. reconnaissance flights have been bringing back photographs as well as verbal reports, and the photographs, some striking examples of which are published this week, show an astonishing amount of detail. Aerodromes, substitute landing grounds, ports and naval bases, railways, canals and navigable rivers, military and com-

WAR IN THE AIR (CONTINUED).

mercial main roads, all have a story to tell. Movements by road, rail or water are soon known to the Allies and in the matter of information, we have a decided advantage.

Photographs of a naval base may tell not only the number, but also the identity of the ships in harbour, whether they have steam up or appear to be fuelling, and whether there is activity in the building yards.

Much useful work is done by comparison with earlier photographs of the same scene. Every change is noted, and the trained intelligence officer, who may spend hours poring over a single print, sees much that the ordinary observer would pass over. Shadows, for instance, form a useful clue during interpretation.

Photographic Equipment

EACH aircraft carries two cameras, one vertical type and one hand type, held for oblique shots. Both are compact and virtually foolproof. They are designed to work in the worst circumstances and require very little attention. The vertical type is completely automatic, and contains an interchangeable film magazine, big enough to give 125 exposures. The film magazines can be changed in the air in a few seconds. At the start of a flight, a van crosses the aerodrome to the waiting bomber. Cameras, drums of ammunition and other equipment are transferred to the aircraft, and the vertical camera is screwed into place; the oblique camera is placed ready in the fuselage. The vertical camera is set before the flight begins, according to the probable actinic value of the light and flying altitude. Should there be an error it is usually possible to make allowance for over or under exposure in the final processing.

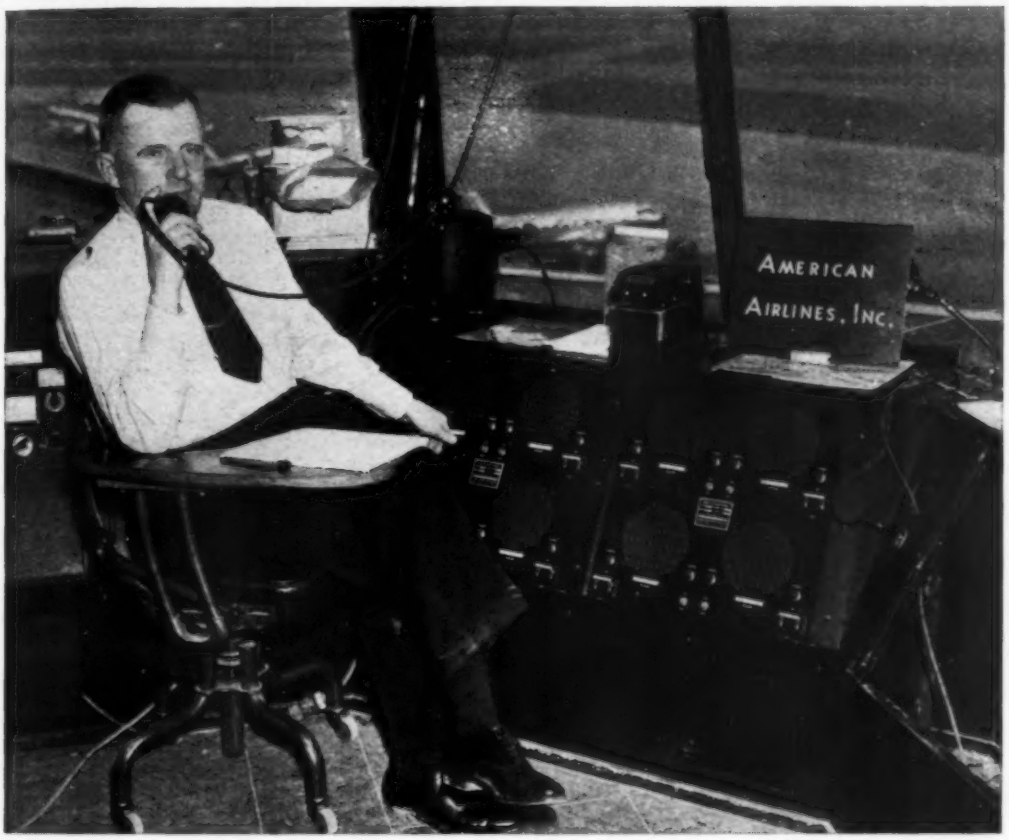
Meanwhile, the engines are warmed up and the crew have come aboard. Each knows the others' work and has been trained to co-operate. The aircraft takes off for Germany. The purpose of this particular flight is, let us say, to obtain information of certain enemy aerodromes, and on approaching the first objective the pilot takes the aircraft down through the cloudbank, sees on the left the circle of hangars, and swings the machine round towards it. A straight and level course, which is necessary for good aerial photography—though it makes gunfire from ground defences more dangerous—is set over the middle of the aerodrome, the cameras are started, and after photographing 20 or 30 German aircraft lined up 2,000ft. below, the aircraft goes on to its next object.

It is not until the R.A.F. machine reaches the second aerodrome that it encounters opposition. Most of the necessary photographs have been taken, however, before the enemy fighters dive down on the raider from behind. Our air gunners hold their fire until the enemy are close, and in the meantime the British aircraft keeps on its course until the camera has finished its task. Only then does our aircraft slip upwards into the clouds. At the final aerodrome on the list it is necessary to drop to 1,000ft. in order to make sure of getting good results, and the observer now uses the oblique camera. Pom-poms and machine-guns fire at the intruder, but it is off again undamaged.

At home, the magazines are removed for developing and printing, the observer makes his report, and in two or three hours the prints are being inspected by experts. Stereoscopes and magnifiers tell them much that was unseen even by the trained observer in the aircraft. Aircraft will be recognised and activity noted. Such was a typical instance of R.A.F. activity in this connection. Sometimes it is less straightforward, and photographs may have to be taken from as low as 500ft. or as high as 24,000ft.

On the inside looking out. An exclusive action photograph of a duel between a Heinkel He 111 and a Saro London flying boat. We cannot guarantee the authenticity of this but can see no trace of faking in the original photograph.

COMMERCIAL AVIATION



BRINGING THEM HOME: Mr. Gordon Hamilton, in the control tower of the New York Municipal Aerodrome, gives a pilot landing directions by radio.

ECONOMY of AIR TRANSPORT

Some Interesting American Statistics

THE air transport industry in the United States had a good year in 1939. Based on figures for the first ten months, net earnings for the year will be approximately $3,000,000. This compares with a loss of $2,000,000 for 1938, so it appears that the industry has been fortunate enough to turn the corner round which prosperity always seems to be. These figures apply to sixteen of the internal airlines which file monthly reports with the Civil Aeronautics Authority. (There are only three other internal lines and these are very small, and, moreover, carry no mail and receive no mail payment, so the sixteen may be regarded as the sum total of U.S. internal air transport. In addition, lines to foreign countries number four, of which Pan American and Pan American Grace completely overshadow the others in size.)

Only three of the sixteen companies made a loss during the ten months. These were T.W.A., Boston-Maine and Inter-Island. American Airlines had highest earnings and Eastern Air Lines came next. Load factors for 1939 average 56 per cent., as against 50 per cent. for 1938. They varied between 64 per cent. (American Airlines) and 22 per cent. Reductions of fares have occurred and the average for both short and long trips is now about 5½ cents per mile (equivalent to 3.3 pence per mile). The total net income (before deduction of income taxes) for the sixteen airlines for the ten months was $3,389,000. Total revenue passenger-miles amounted to 553,403,000 in the same period.

All these figures are very interesting to air transport operators and to the officials of government departments concerned with the distribution of air mail payments or subsidies to the operators. The figures do not mean that air transport is now self-supporting in U.S.A., for the amounts quoted for earnings would be obtained by subtracting operating expenses from the sum total of receipts (passenger fares, freight receipts, and mail payments from the Government). Such mail payments in U.S.A. are designed to make the airlines financially sound, and are, in fact, a subsidy.

If another source of information, the *Air Commerce Bulletin*, official publication of the Civil Aeronautics Authority, for November, 1939, is consulted, statistics for the airlines for January to June are given. In this half-year the same sixteen companies did the following useful work:—

Flew 279,485,000 revenue passenger-miles.
Carried 2,393,118,000 freight lb.-miles, and
8,128,512,000 mail lb.-miles.

In doing this 37,203,000 revenue aeroplane-miles were flown and 690,193 revenue passengers carried.

For this the airlines received payments of three kinds: passenger fares and freight charges from private users of

the services, and mail payments from the Government. The *Bulletin* gives the Government mail payment to $8,218,000 for the half-year. An approximation to passenger fare receipts can be obtained by using the average fare of 5½ cents per mile. This works out at $15,400,000. Freight receipts are uncertain, but the average rate may be about 2 cents per 100 lb.-miles. The total would then be about $479,000. (As the figure is relatively very small, the accuracy is unimportant.)

These three sums total $24,097,000 and—if the profits earned are not unduly high—the figure may be taken as the total running costs of the U.S. internal airlines for the half-year. In the period 37,203,000 aeroplane-miles were flown, so the average cost comes out at 65 cents per aeroplane-mile (39 pence at the present rate of exchange).

Twin-engined

The aircraft used by the sixteen companies would in almost every case be twin-engined all-metal aircraft with a cruising speed between 180 and 200 m.p.h. and of size from 10 to 21 seaters, sizes which are exemplified by the Lockheed Electra and the Douglas DC 3. Costs per mile for aircraft are difficult to obtain, so this figure, while admittedly not precisely accurate, is of some value in that it gives an idea of total operating cost (including all company overheads and profit) of the modern airliner in U.S.A.

If the half-yearly mail payment be doubled, the annual Government contribution is about $16,500,000 less the amount which the Post Office recoups in the form of mail surcharges. No information is available on this figure and in what follows it has been neglected. Converted at the present rate of $4.02 to £1, the figure is equivalent to just over £4 million per year. For this small sum—less than one day's wartime expenditure—the U.S. Government has its air main conveyed for a year and gets all the intangible but quite real advantages of a transport facility which enhances the civil life of the community and is a very important aid to the defence of the country in time of war.

All this shows the low cost of civil aviation. Even leaving out its use in defence—which cannot, of course, be valued—and charging the $16½ million only against the useful civil work done, the return for the expenditure is excellent. If the whole sum were charged up solely against mail-carrying—a grossly unfair procedure—the Government only pays 10 cents per 100 lb.-miles; if all against passenger-carrying, 2.94 cents per passenger-mile. Or converting it into an average rate per aeroplane-mile flown it becomes 22 cents (that is, 13 pence per mile). It can thus be seen that the Government mail payment is one-third of the total running cost (including profit) per mile, which was worked out above to be 39 pence per mile.

An outstanding point is that of the approximate total of the airline companies' receipts for the half-year of $24 million, just over $8 million was Government mail payment. Putting the receipts out into percentages, the following result is obtained:—

	Per cent.
Government mail payment	34
Passenger fares	64
Freight receipts	2
	100

It is also significant that a Government contribution of about $16 million was required to allow the airlines to earn a profit of about $3 million. So without Government support the airlines would not be able to keep running. Apparently civil aviation cannot yet "fly by itself." It will approach this more and more as the load factor goes up. Fifty-six per cent. is not a discreditable figure, but 70 per cent. should be attainable. And operating costs should fall with increasing volume of production of aircraft.

Copenhagen—Hamburg

LAST Monday a new air service was started between Copenhagen and Hamburg. For the present the aeroplanes will carry mails and goods only.

The Blockade and the "Clippers"

THE extension by Great Britain of her blockade to search of mails on the Pan American "Clipper" flying boats at Bermuda has added yet another complication to the delicate question of this country's right to search the sealed mails of neutral countries. American views regard the clause in the Hague Convention as intended to cover the diversion of ships to British contraband control stations, but consider the case of the flying boats calling at Bermuda to be on a different footing. It is even hinted that if Great Britain persists, the boats may avoid Bermuda altogether and fly via the Azores. In that case, the dispute between the Pan American and American Export Lines would probably be affected.

French Civil Aviation

A DECREE of the French Government abolishes the Directorate of Civil Aviation, or, more exactly, adds it to the Directorate of Aerial Transport. This directorate had been established at the start of hostilities along with the Directorate of Civil Aviation and M. Louis Allègre, managing director of Air France, had been placed at its head. Evidently these two directorates overlapped and one has been abolished.

The new directorate is a branch of the Directorate of General Transport, which comes under the Minister of Public Works. The duties of the Directorate of Aerial Transport consist in providing communication and transport services by aircraft, to study and propose to the Minister all the ways of performing these services, and to control their application.

The new organisation provokes our contemporary *Les Ailes* to two comments. The first is favourable: the presence of M. Allègre in this high position will ensure, despite the war, the development of commercial aviation. The second is inspired by a doubt: does the abolition of the Directorate of Civil Aviation signify the irrevocable suppression of all private flying?

It seems that *Les Ailes* has its doubts, as well as *Flight*, on the subject of civil aviation. While it seems inevitable that private flying must cease in England, it is hoped that commercial aviation will be allowed to develop as fully as possible.

Lord Willingdon in Sydney

LORD and Lady Willingdon arrived by air in Sydney on January 16, on their way to New Zealand, where Lord Willingdon will represent the United Kingdom Government at the Centenary Celebrations.

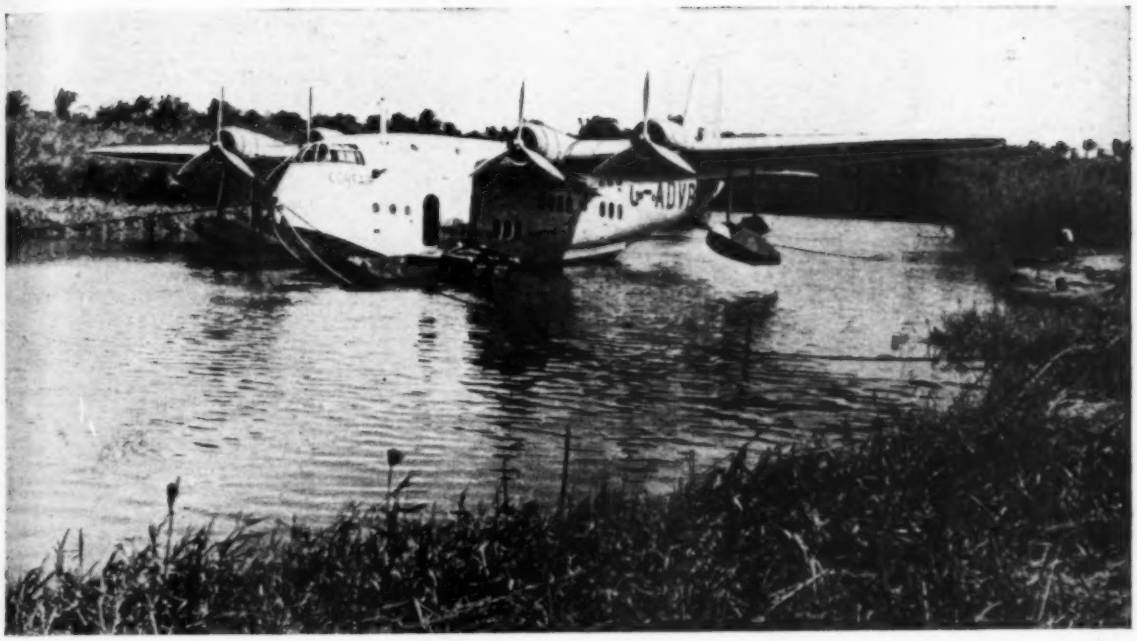
Yukon Southern's Territory

THE Yukon Southern Air Transport, which operates from the Trans-Canada Air Lines termini at Edmonton, runs services northward into the Peace River country, calling at Peace River and Grande Prairie. This is a linking service on the 1,100 miles route between Edmonton in mid-Alberta and White Horse in southern Yukon. The regular timing for this 1,100 miles trip is seven and a half hours, but in the late autumn it was flown in five hours ten minutes, including two stops, by one of Yukon Southern's new twin-engined Barkley-Grows

Branching off the long northward line are link routes with services from Dawson Creek and Fort St. John to Prince George on the western side of the Rockies and southward to Vancouver. Also from Prince George a short triangular route is covered over the Fort St. James gold-mining country. From Fort Nelson in the north-east corner of British Columbia a short service connects with Fort Liard just north of latitude 60°, and from Fort Nelson there follows a long hop north-west to White Horse.

From the gold mines of Yukon the company's machines are now carrying about three and a quarter hundredweights of gold dust and bullion each week. Besides gold and mails, there are frequent and growing consignments of supplies for lonely trappers, materials like canned meats, fruits, coffee, sugar, flour and medicines, while pelts are picked up from remote settlements located on lakes in the frozen north.

At Fort Nelson a log cabin has just been completed for the radio operator, and of the three Barkley-Grow machines recently acquired by Yukon Southern, two fitted with wheels are used between Edmonton and Fort St. John, and the third fitted with floats is used to continue the 1,100 miles northward trip from St. John to White Horse. A point of interest connected with the recent news that Rear Admiral R. E. Byrd is on his way to the Antarctic is that the floats from one of these Yukon Southern machines have been loaned to the explorer to fit on a similar machine he will use during surveys of the Antarctic coast.



Afloat again and ready for the take-off.

A SALVAGE EPIC

"Corsair," after being Marooned, Flies Back from Congo : Refloated and Taken Off from Barrage-Deepened River.

ON January 15, 1940, Captain J. C. Kelly Rogers at last landed *Corsair* in England after she had been lying on—and in—a small river in the heart of Africa for ten months. The big flying boat showed some honourable scars on her hull, but otherwise was still a boat capable of flying home through the present bad Mediterranean weather in two days instead of the usual three.

Aviation is a great stimulus to the study of geography, for the little village of Faraje—the cross marking the spot—takes a lot of finding on the map. It is some 3 degrees north of the Equator, in the Belgian Congo, and about 150 miles south-west of Juba. It was here, on March 14, 1939, that *Corsair* was forced to land, being off her course when flying homeward from Port Bell, on Lake Victoria, to Juba.

Bad Luck in Landing

The landing must have been a nicely judged manœuvre, for the River Dungu is only about 50yd. wide, very little more than the span of the flying-boat. All would have been well but for a submerged rock which, near the end of the run, ripped a large piece out of the chine. With presence of mind, the pilot opened his throttles and ran the machine at the steep bank. There he held her by her engines until all passengers had been disembarked. After which she slid gently back into the water and sank, but luckily not deeply enough to submerge the engines, except for one carburettor. There were no injuries and no loss of mail or freight.

Subsequent salvage operations indicate such persistence and engineering imagination that even Kipling's engineer, Hinchcliffe, would have been moved to admiration. And he was a man who, "given an oilcan, could coax a stolen bicycle to do typewriting." The river was, of course, not good enough for a take-off, so it was decided that the river *should* be made good enough.

A barrage was built to bank up the water.

Simple words, but a barrage meant stone, and stone meant a quarry; and that meant labour and transport. So, with native prisoners supplied by the Belgian Congo authorities, a road was made through 2,000yd. of bush to connect with the nearest road, and quarries were opened on each bank. Then wooden box frames, made out of local round timber, were placed across the stream at 10ft. intervals to form the barrage. After placing, they were filled with stone transported by the natives. Clay was tried in an attempt to make the barrage watertight, but had to be abandoned in favour of "antbed," that strange material of which anthills are made in tropical parts. (Being hard-setting, it is used for tennis courts in northern Australia.) To further prevent leaks, a mat of rushes and canes was woven along one face of the barrage.

Engines Removed

A nearby gold-mining company, Kilo Moto, gave much aid in all this construction work. Meanwhile, the Imperial Airways engineers had been at work on *Corsair*. Lightening her as much as possible, even to the extent of removing the engines as well as cabin furnishings, she was jacked under one wing from the bank and raised on the other side by a raft of oil-drums. This was got into place by filling the drums with water and partially submerging them. They were then pumped out, and so lifted the boat. With the

hole above water, a temporary patch was put on and *Corsair* beached with the aid of a beaching chassis, specially sent there, and some 200 or 300 native boys. On the bank the permanent patch was put on and the engines re-installed.

That sounds easy, but the work was done in equatorial Africa on a river-bank. No heat-treating furnaces, no power riveters, and the only roof overhead was the wing. Engineers are traditionally an inarticulate race, but there may have been occasions during the the salving of *Corsair* when exasperation released the floodgates of speech. Sleeping each night at Aba, a small village of thirty to forty Europeans—the Greek and Cypriot shopkeepers sell cheap merchandise to the natives—it was a 40-mile drive to work every morning.

Dural Earrings

The ten month's stay of *Corsair* must have been a purple patch in many a native's life. The stories of the sojourn will be told far and wide, and split pins through noses, dural rivets for earrings, and alclad bracelets will bear witness to the gossip as the women pound the mealies. One askari, who mounted guard each night with a muzzle-loader, was particularly proud of his overcoating by Rumbold.

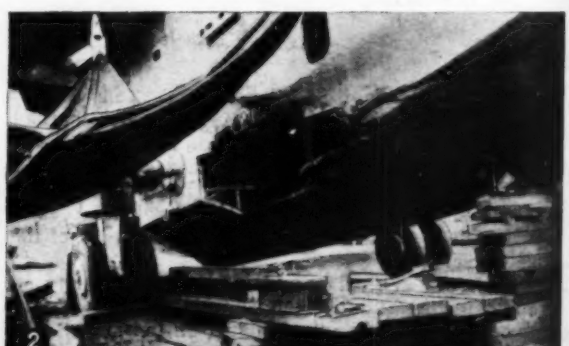
By July 13 everything was ready for the take-off, rocks having been blasted from the stream. Unfortunately, early in the attempt a submerged rock was hit and further damage resulted, and the boat again sank. The wet season now being over, the river was falling, and salvage was thought to be impossible. Dismantling was about to be commenced. But it was Mr. Halliday, sectional engineer at Alexandria, who had faith in the feasibility of salvage and asked for another attempt to be made.

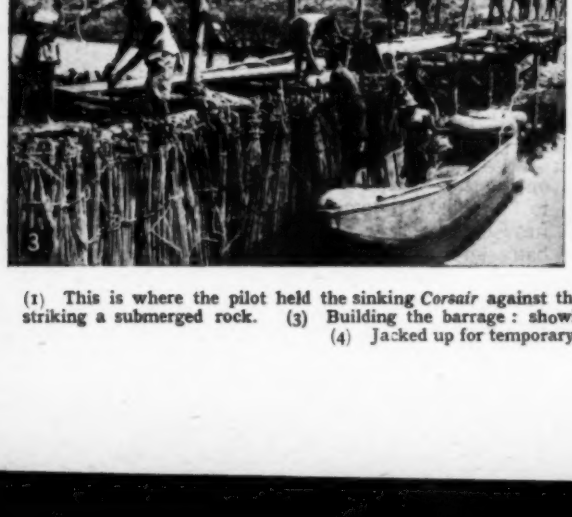
A more elaborate barrage was built, trees were cut down, and the five engineers went through the whole heart-breaking business of refloating and repairing the boat. The barrage, 10ft. high, backed the water up to 4ft. 9in., and gave 5ft. of water over the highest rock. The boat drew 3ft. 6½in. at its take-off weight of 30,162 lb., at which weight Captain Rogers was confident he could fly her off. Before going out he had conducted tests and found that the boat should get off in 375yd. at Faraje, which is 2,600ft. above sea level.

The Take-off

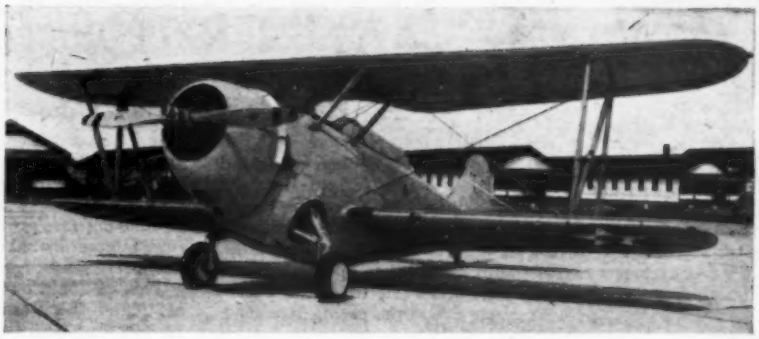
A length of 600yd. was available for take-off, and all arrangements finally approved. When it was remarked to Captain Rogers how lucky he was to get as much as 600yd. of such a river straight, he answered, "It wasn't." (And this on a stream only about 50yd. wide.) To aid in steering the take-off, wicker baskets were made and placed at intervals along the bank as sighting marks.

And so *Corsair* was lifted out of the Congo under her own power. With a crew of four aboard, one of whom was stationed at the stern with the anchor in case of trouble, she took-off downstream quite comfortably, and was even held down to give a little more flying speed. It was the cool of the early morning when she left Faraje. Soon she was at Juba for refuelling, and then proceeded normally to Alexandria, where a complete maintenance check was given during her three-day stay. Then with a final flourish *Corsair* careered home in two days instead of the schedule three.





(1) This is where the pilot held the sinking *Corsair* against the bank with the engines. (2) The damaged chine, caused by striking a submerged rock. (3) Building the barrage: showing the mat of rushes and the box frames to be filled with stone. (4) Jacked up for temporary patching prior to beaching.



This experimental Great Lakes dive-bomber was of special interest because it carried its bomb internally and, although a biplane, had a retractable undercarriage.

incorporated in certain machines which would otherwise attain too high a speed for the pilot to take accurate aim. Special reversible-pitch airscrews have also been tried with the same end in view.

Under high-speed diving conditions the airscrew—if it is of the fixed-pitch type—will "windmill" the crankshaft round far beyond the approved r.p.m. and will result in a relative increase in the dynamic loadings and stresses of various vital components of, perhaps, more than 70 per cent. Fortunately, airscrew design has made exceptional progress during the past few years. Not long ago a Curtiss machine attained a speed of 575 m.p.h. in a 9,000ft. dive, but, being fitted with one of the new electrical automatic constant-speed airscrews, the engine at no time exceeded 2,550 r.p.m., its rated figure for normal level flight.

As countries have their own pet ideas on the design of dive-bombers, let us examine selected types according to nationality.

Although America can in no sense be considered to have "invented" dive-bombing, this country has done more to develop specialised equipment than any other, and will accordingly take pride of place in this survey.

It was ten or eleven years ago that the Martin 125 and original Curtiss Helldiver marked the rise of interest in the technique of dive-bombing with comparative heavy loads. The Martin was the larger machine and was capable of carrying a 1,000-lb. bomb in a terminal velocity dive and of recovering without dropping the bomb. The t.v. speed was about 260 m.p.h., and the makers were very proud of the fact that, even with the bomb in position, the 125 was capable of all normal aerobatics, including loops, rolls and inverted flying.

Modern Helldiver

To-day the Curtiss Company still has a Helldiver, though this bears not the slightest resemblance to its forerunner. Actually the name is applied to an export version of the SBC series (Marks 1-4) as used in large numbers by the U.S. Navy's aircraft carriers. The machine is an exceptionally clean biplane, with heavily staggered wings and single interplane struts. The undercarriage retracts into the sides of the fuselage behind the Cyclone engine. A single large bomb is carried externally beneath the fuselage and smaller projectiles can be slung beneath the wings. The fuselage bomb is provided with displacement gear, precise details of which have not been released. It may well be that this resembles the gear patented by Messrs. Schuyler and Miles (United States Navy) and D. A. Chadwick. This comprises a shaft secured to the fuselage with two displacing members, each capable of revolving separately upon the shaft and having a limited lateral motion in respect to the aircraft. A spring-backed swivelled fork member is mounted at the end of each displacing member, the forks being adapted to engage lugs fitted on the bomb. Elastic cords are fixed to each displacing member, the other end of the cords being secured either to the bomb rack or to the structure of the aircraft.

On the lower wings of this unusual Curtiss biplane are "double-split" flaps which open like the leaves of a book to retard the speed in a bombing dive. A constant-speed airscrew keeps engine r.p.m. within desired limits.

The Douglas concern, apart from its TBD-1 torpedo-bomber monoplane which is used for dive-bombing, has two types (actually Northrop designs) in service with the U.S. Navy. In appearance these resemble the Northrop attack machines and Bristol's flying test bed for the Hercules, but are specially stressed for dive-bombing and have split trailing edge flaps which, incidentally, are perforated as on other modern Northrop designs.

One of the most interesting American designs is the Brewster XSBA-1 mid-wing monoplane. One version of this has been released for export and another is being built at the Naval Aircraft Factory, Philadelphia. The bomb is stowed internally and the speed-reducing flaps are of unusual design as shown in our photograph on page *c*.

Vought dive-bombers include biplanes and the SBU series of monoplanes, the latter being capable of handling a 500- or a 1,000-lb. bomb.

As long ago as 1935 Hawkers produced their P.V.4 Pegasus-engined dive-bomber, which looked like a large Pegasus-Hart and which was the first British bomber to be evolved specifically for diving attacks with a 1,000-lb. bomb load. Notwithstanding its great strength the structure weight was only 27½ per cent. of the gross weight.

The best current example of a specialised British dive-bomber is the Blackburn Skua, which has special diving-brake flaps with a combined area of 18.5 sq. ft. These are metal-covered and are normally stowed flush with the lower surface of the wing, being inset from the trailing edge. They limit the diving speed to about 220 knots. Like the Swordfish and Shark TSRs, the new Fairey Albacore deck-landing biplane is capable of delivering diving attacks with a heavy bomb-load. The pilot, being situated in front of the wings, has an excellent view over the nose.

Dive-bombing is practised by squadrons of the R.A.F. equipped with the Fairey Battle Merlin-engined monoplane. This machine carries its bombs on hydraulic jacks which are normally retracted into the wing, though for dive-bombing they are lowered beneath the wing surface. The normal bomb-load is stated by the Fairey Company to be 1,000 lb. External stowage can be provided for the following U.S. pattern bombs: Ten 120-lb.; three 285-lb.; two 625-lb., or one 1,100-lb. Diving brakes are not fitted, but the machine has frequently demonstrated in public its ability to make diving attacks.

German Practice

Apart from the small single-seater Henschel Hs 123, Germany uses large numbers of Junkers Ju 87 single-engined two-seater dive-bombers. The Ju 87 has a cranked wing which carries diving brakes in the form of slats mounted just aft of the leading edge on each side. These are adjusted edge-on to the air stream for dive-bombing operations. Without them the T.V. speed is 430 m.p.h. It is possible to carry a single 550-lb. or 1,100-lb. bomb beneath the fuselage, and there are external wing racks for four bombs of 110 lb. each. Diving brakes somewhat similar to those on the Ju 87 are fitted to the Fokker G1.

It is believed, incidentally, that Germany's new high-speed twin-engined bomber, the Junkers Ju 88, is stressed for delivering diving attacks at a comparatively shallow angle. This form of attack obviously lacks certain advantages given by the vertical or nearly vertical dive.

Apart from some old Gourdou-Lesceurre single-seater parasol monoplane dive-bombers, the French Navy has a number of Loire-Nieuport 40 cranked-wing monoplanes with Hispano 690 h.p. engines. These are single-seaters. A number of Vought monoplanes has also been acquired.

One of the most modern dive-bombers in the world is Italy's Savoia Marchetti S.M.85 twin-engined high-wing monoplane. The trailing edge flaps on this machine hinge through 90 deg. to act as diving brakes.

ALL MANNER OF THINGS

"A. Viator's" Weekly Causerie

THERE is now a regular daily link between England and Scandinavia by K.L.M. This supplements the already existing D.D.L. link which has run regularly for some considerable time on three days a week. Later I expect that the Dutch and Danish companies, which run in very close and friendly co-operation, will arrange that the three-day-a-week service to which I have referred will become a daily service, thus giving two England-Scandinavia connections daily.

There is large and growing traffic both of passengers and freight between England and Scandinavia, a fact which certainly seems to justify double daily services in either direction; and with the early introduction of summer time some natural alleviation of the difficulties of operating air lines with almost no navigational assistance will follow automatically, even though the authorities continue to brood and do nothing in this very important matter.

I am told that the air service between Stockholm and Helsinki has had to be suspended owing to the nasty behaviour of the Union of Singularly Soapless Ruffians who infest those parts by air, but I am glad to note that a service is in operation, despite the Mongol hordes, as far as Åbo. It was at Åbo, when on the way to Helsinki last summer, that I saw a group of huddled furtive-eyed dock workers (as I supposed) in peaked caps. These, I was informed, were pilots and crews of the Russian State Air Lines.

The "Liberators"

Now if you consider that some of the best class and nicest men of practically every other nation are to be found as air line pilots wherever you go, it is surprising—or perhaps it is not—to find that the Bolshevik ideal is so low. These are probably as high a type as Russia of to-day produces, and it is the sub-man with the sub-machine gun, who proposes to "liberate" a highly cultured free people like the Finns, who have already proved in battle that one Finn is worth twenty Russians.

The remarkably hard weather in Holland has brought grist to the K.L.M. mill, and incidentally it has proved once more how essential civil air transport is, not only as a normal means of transport, but in any emergency also. Some of the Dutch islands have had no link with the mainland for some time except through K.L.M., and continuous services have been run, conveying not only passengers but essential foodstuffs. Whole planes have been packed with meat and butter for example; schoolchildren have been able to attend school on the mainland, thanks to air transport, and doctors and medical supplies have been carried.

There was even a case, I am told, of a whole funeral, including the mourners, being conveyed to one of the remoter Dutch islands by air. Landings in many cases have been made on the frozen seashore, where the surface has been as hard as concrete, and the available space has been practically converted into an airport, with boundary flags and even a smoke smudge wind indicator, whilst runways of the appropriate length have been marked out. Soldiers on leave on the mainland have been carried back (reluctantly it is assumed) to their island stations, whereas the schoolchildren have enjoyed their air travel between school and home.

On the line to the Far East I hear that there have been a number of "Nursery planes" for kiddies whose parents are in the Colonies. These have been organised, so far as the children were concerned, by the alert and charming Chief Air Hostess of the company, Miss Ena Boomkamp.

Major C. C. Turner, in a brief but able article in the *Daily Telegraph*, discusses the after-war problems of the new British Overseas Airways Corporation who, however short of flying material they may be, will surely not lack pilots capable of flying to such places as Berlin, Prague and Vienna, and who will merely have to get out of the habit of dropping pamphlets. Major Turner supposes that B.O.A.C. will retain the British Airway's prerogative of purchasing foreign aircraft, but he points out that of two similar commercial types, one British and one American, the D.H. Flamingo is superior to the Douglas D.C.5.

This is doubtless the case, and for that particular class of 'plane the Flamingo will therefore probably be purchased, but it is the *possibility* of buying whatever flying stock is best for the operation of various sorts of air route which is the important thing.

Everybody agrees that British civil pilots are, and have been, second to none, and that British business ability in planning and executing air communications has nothing to learn from America or any other country. Everybody who will look facts in the face is perfectly well aware that (apart from flying boats) the flying material which Imperial Airways has been compelled to use was by no means up to the necessary standard. Indeed, there have been aeroplanes on some British lines, the only ones to be got at the time, which placed Imperial Airways in the position of a shipping company to-day which should be obliged to operate *Great Eastern* type paddle steamers built in 1858 or thereabouts.

The mere fact that the new Corporation may be permitted to buy in America may serve to produce the finest commercial aircraft in the world, built in this country under the spur of American competition.

If I am compelled to buy my cigarettes from one shop only I shall not get what I want, but on the contrary, I shall have to buy, at an excessive price, the by-product of an artificial manure factory, badly packed in indifferent paper of a non-inflammable nature. It won't be because the shop-keeper cannot provide what I want, but because he is a monopolist who does not give a hoot for me.

When Dutch, Belgian, Swedish and other air companies could not find what they wanted in the way of air liners in Europe, they bought in America and operated efficient air services. They would buy British fleets if they found something better over here than they can get in the States. It is as well to look these facts in the face at times, and this seems to be a good time to do so.

Not So Funny

Lord "Haw Haw," premier radio comic of our era, is losing his grip, I fear. So depressing was one of his recent comic strips that somebody died after listening to it. Much the same fate has almost overtaken me, I must admit, when listening to B.B.C. selected British *soi-disant* comedians, but I always expect to be convulsed with "arty lar'ter" after listening to the Zeesen buffoon. Brace up, therefore, "Haw Haw," and try to *tickle* Britons to death, when, no doubt, you will achieve one of these easily won decorations made of a substitute for a substitute for ersatz tinsel.

Tinsel is hard to come by in Germany, I believe, since Uncle Stalin decided to decorate a million of his crack (and don't they crack when the Finns come after them) troops for long-distance running towards the base.

I understand that General Ivan Orrorofwarski and Peoples Commissar Pushoffomekin had considerable difficulty in pinning the medals to the tails of the coats of the brave troops as they flashed past, homeward-bound. Ultimately they tied them to darts, and many a pair of retreating pants were thus skilfully bedizened with a pewter portrait of good, kind Comrade Stalin.

I read Uncle Goebbels' speech with amusement and noted that we are to be destroyed. Somebody should present our excitable little pal with a copy of "There'll always be an England" on his next birthday, together with a little song entitled "Britannia rules the waves," which, incidentally, goes on to remark that Britons, my dear Doctor, never, never, never (three times) shall be slaves. A. VIATOR.

BRITISH AIRCRAFT WALL CARD NOW AVAILABLE

This new *Flight* copyright chart of British aircraft is now available. Measuring 22½in. by 14½in., it embodies 90 drawings enabling ready identification. Price 1s., postage 6d. for one or two copies, 7d. for more than two copies.

SERVICE AVIATION

WHATEVER THE WEATHER. A Gladiator of the Meteorological Flight taking the daily set of readings. Come rain, come fog, "Met" machines must get their readings up to ceiling.

Royal Air Force Promotions and Official Announcements

African Training Scheme

A LARGE intermediate and advanced training school is to be established in East Africa. The R.A.F. have acquired land near Nakuru, Kenya, where pilots, who have already had some training elsewhere in Africa, will be trained for overseas service.

Head of Empire Air Scheme

THAT Air-Vice Marshal G. M. Croil will be head of the Empire Air Training Scheme has been announced by Mr. Rogers, Canadian Minister of Defence. Air Vice-Marshal Croil entered military life when he enlisted in the Gordon Highlanders in 1914 as a private.

Further details of the scheme, which involves a total cost of about £120,000,000, are now available. A Canadian estimate says that the scheme will require 30,000 airmen, 2,680 officers, 5,000 civilians and a maintenance staff of 1,000. About 70 schools will have to be set up and these will be subdivided as follows:—

Initial training, 3; elementary flying training, 13; service flying training, 16; air observing, 10; bombing and gunnery, 10; air navigation, 2; radio, 4. In addition, staff training schools will be needed for: Air armament, 1; aeronautical engineering, 1; administration, 1; equipment and accountancy, 1; flying instructors, 1; recruit depots, 2; technical training, 2; repair depots, 3; equipment depots, 3; record office, 1.

Awards for Gallantry

THE King has approved the following awards to members of the Royal Air Force for gallantry in flying operations against the enemy:—

Distinguished Flying Cross.

Carey, Pilot Officer Garth Wells Fuller.

Distinguished Flying Medal.

Crumpton, Leading Aircraftman Rex Arthur.

Pilot Officer Carey and Aircraftman Crumpton were respectively pilot and air gunner of one of three aircraft carrying out a patrol over the North Sea in January when two enemy aircraft were encountered. Pilot Officer Carey opened fire at very close range, and succeeded in driving the first enemy aircraft into the sea in flames. He then engaged the second enemy aircraft until he had exhausted his front gun ammunition. By skilful manoeuvring he enabled Aircraftman Crumpton to bring his rear gun into action at point blank range. Considerable damage was inflicted on the enemy. The skill and coolness displayed by Aircraftman Crumpton in the manipulation of his gun played a large part in bringing the combat to a successful conclusion.

FLIGHT

NEW 'FLIGHT' CHART OF BRITISH AIRCRAFT

THE series of *Flight* Identification charts of German aircraft are in widespread use throughout the country and abroad in the B.E.F. The latest chart to be published is one depicting 19 of the principal types of British aircraft now in use, and reproduced on page 81.

In addition to broadside, head-on, over-head and under-side views, in which the chief characteristics are delineated, they are also briefly described in the text further to assist identification. The cost is one shilling each, plus sixpence extra for postage on one or two copies and sevenpence extra for more than two copies.

In addition to this enterprise, which has been of the greatest possible use to observer units and anti-aircraft detachments throughout the R.A.F., *Flight* has provided and is still at work on special charts for Service use, to the order of H.M. Board of Admiralty and the Air Ministry.

Royal Air Force Gazette

Royal Air Force

General Duties Branch.

Air Marshal Sir C. L. Courtney, K.C.B., C.B.E., D.S.O., is appointed Air Member for Supply and Organisation on the Air Council with effect from Jan. 15, vice A. V-M. (Acting Air Marshal) W. L. Welsh, C.B., D.S.C., A.F.C.; F/O. D. L. Amlot, D.F.C., is granted a permanent commission in that rank (Nov. 6, 1939).

The following ex-Flight Cadets are granted permanent commissions as Pilot Officers on probation: (Dec. 23, 1939) H. J. Alderson, D. M. Agnew, P. B. Balean, A. H. W. Ball, D. M. Barbour, J. T. Berryman, F. R. Bird, P. F. Blackford, J. W. L. Bruxner-Randall, C. M. Burfield, B. Clegg, R. H. Clifford, A. R. T. Cox, T. J. F. Davey, J. H. Deas, D. D. Haig, J. F. Hatton, R. L. Hicks, R. R. Langley, M. F. S. Laughton, P. de L. Le Cheminant, A. D. Livingstone, D. T. M. Lumsden, J. M. MacDonald, R. A. MacFarlane, R. B. Morison, J. E. Newton-Clare, R. W. Pye, G. H. M. Riddell, F. A. Robinson, D. C. Sharman, S. A. C. Sibley, T. N. Smyth, M. M. Stephens, P. C. F. Stevenson, C. B. Temlett, K. T. P. Terry, P. C. Thomas, P. W. Vaughan, R. Veal, F. A. Vigors, R. L. Wade, A. E. Whitworth.

The following Pilot Officers on probation are confirmed in their appointments on the dates stated: (Oct. 31, 1939) R. G. Manlove, P. R. B. Wanklyn; (Dec. 5, 1939) D. G. A. Stewart; (Dec. 12 1939) G. L. Edmonds; (Dec. 19, 1939) G. K. Brackenridge; (Dec. 27, 1939) H. G. Dawlish; (Dec. 28, 1939) L. S. Adams, P. A. F. Addie, J. F. E. Andrews, W. H. Arnold, E. N. Baker, J. R. Bellerby, D. G. Belyea, R. H. M. Bennett, J. S. Booth, T. H. Borg-Banks, C. J. A. G. Brain, J. Brain, P. G. Brodie, A. C. P. Clayton, J. G. Cole, A. B. Corbett, M. A. Craig-Adams, L. E. Cryderman, H. Davison, J. H. Day, C. H. Dearden, P. M. De Mestre, P. G. Dexter, A. W. Dunn, R. G. Egerton, V. G. W. Engstrom, J. Falkson, R. L. J. Fitch, J. M. Gilmer, J. C. Hall, J. S. Hart, G. B. Hawes, H. M. T. Heron, B. A. H. Hitchings, R. J. K. Hogg, D. F. S. Holbrook, J. G. Hughes, T. G. Hynes, H. O. Jones, W. J. King, L. C. Kingsbury, I. R. Krohn, O. H. Launders, J. L. Leeds, A. S. Linney, I. F. McDermott, P. W. Mason, C. Matheson, K. W. Michie, G. G. K. Nolan, A. C. Ollerenshaw, R. E. Packington, A. E. P. Pim, D. K. Plumb, C. P. D. Price, P. M. Procter, J. D. Robertson, L. O. Rogers, R. M. Rogers, C. K. Scott, D. Secretan, A. J. Simpson, G. L. Sinclair, B. W. Smithers, C. E. Staples, D. B. Starky, W. H. Thallon, J. R. Thompson, H. W. Thorburn, J. D. True, M. W. Walders, W. B. Wheelwright, G. R. T. Williams, R. A. G. Willis, A. F. M. Wilson, P. Wyatt-Smith, C. R. Wylie, L. D. M. Scott; (Dec. 29, 1939) R. Lambert; (Dec. 30, 1939) R. F. Earl; (Jan. 6) G. St. C. B. Reid, W. C. Timoney.

The following Acting Pilot Officers on probation are confirmed in their appointments and graded as Pilot Officers: (Nov. 18, 1939) N. B. Fawcett, F. McK. Goyen.

The following Acting Pilot Officers on probation are graded as Pilot Officers on probation: (Nov. 18, 1939) F. A. G. F. J. de Labouchere-Sparling, D. C. Barker, J. W. Blennerhassett, B. S. Booth, D. D. M. Butcher, F. B. Burningham, E. F. K. Campling, C. W. W. Darwin, J. H. Edwards, K. R. Gilman, J. H. Godwin, A. H. N. Gooch, P. S. Handley, A. Harte-Lovelace, J. E. S. Hill, R. James, D. T. Jay, G. J. Lynes, H. N. Masterson, E. A. McLundie, R. A. Marchand, J. L. Moore, I. A. Merrin, M. R. Mudie, G. W. Nicholson, H. C. R. Pirie, H. K. Ralph, T. D. Saul, T. B. A. Sherrington, B. Y. Sowter, A. J. Strachan, R. I. Sworder, F. B. Weir, D. R. West, R. J. S. Wootton.

The following Flying Officers are promoted to the rank of Flight Lieutenant, with effect from Jan. 6, and with seniority of Jan. 6, 1939: M. J. Muspratt-Williams (Lt., Lincolnshire Regt.); G. F. Watson-Smyth (Hon. Flt. Lt.) (Capt., Duke of Cornwall's L.I.), R. H. N. Graham (Capt., W. Yorkshire Regt.) (Hon. Flt. Lt.), B. B St. G. Daly (Hon. Flt. Lt.) (Capt., Lancashire Fus.), N. B. Hallmark (Hon. Flt. Lt.) (Capt., Cheshire Regt.)

The following Pilot Officers are promoted to the rank of Flying Officer on the dates stated: (Oct. 8, 1939) G. K. F. Garrad; (Dec 10, 1939) W. G. New, D. B. Pearson; (Dec. 31, 1939) P. F. Eames; (Jan. 5) R. E. P. Brooker, J. B. H. Nicholas; (Jan. 6) G. C. B. Woodroffe, C. O'Donoghue; (Jan. 7) A. G. Worcester; (Jan. 10) D. C. G. Clinkard, K. R. H. Sylvester, J. G. Fletcher, R. H. Kewish, A. G. Wilson; (Jan. 12) J. N. Thornewill, D. C. McKinley, D. S. G. Honor, W. G. Taylor, W. H. Flint, R. M. Milne, R. P. Y. Cross, A. J. Blackwell, E. J. Morris, P. McC. Bond, K. J. Henderson, A. R. Ball, P. J. A. Byers, W. J. Burnett, L. H. Eno, L. E. Ellis, G. B. Morgan-Dean, M. W. H. Uphill, L. F. Malone, H. M. Ferriss, D. W. S. Howroyd.

Air Comdre. J. B. Bowen, C.B.E. (R.A.F., Ret.), relinquishes at his own request the rank of Air Commodore while re-employed with the Royal Air Force and is granted the rank of Group Captain (Sept. 1, 1939). Wing Comdre. J. C. P. Wood is cashiered by sentence of General Court Martial (Jan. 6). Group Capt. E. A. Fawcus is placed on the retired list (Jan. 10). The short service commission of Acting Pilot Officer on probation N. R. Selkirk is terminated on cessation of duty (Jan. 5).

Equipment Branch.

Pilot Officer on probation S. McN. Greig is confirmed in his appointment (Sept. 12, 1939).

The following Pilot Officers are promoted to the rank of Flying Officer:—(Nov. 28, 1939) H. J. S. Anderson, J. C. Blyth, T. C. Davies, S. McN. Greig, T. I Plant, J. Ross.

Accountant Branch.

Pilot Officer on probation R. D. I. Scott is confirmed in his appointment and promoted to the rank of Flying Officer (Nov. 28, 1939).

AIMING TO BE BOMB-AIMERS. Both the Luftwaffe and the Royal Air Force use indoor moving targets for primary bombing instruction.

Medical Branch.

F/O. R. C. Jackson, M.R.C.S., L.R.C.P., is promoted to the rank of Flight Lieutenant with effect from Nov. 16, 1939, and with seniority of Nov. 16, 1938. (Substituted for notification in *Gazette* of Jan 5.)

Commissioned Engineer Officers.

W/O. S. F. Browne is granted a permanent commission as Flying Officer on probation with effect from Dec. 18, 1939, and with seniority of June 12, 1939.

Royal Air Force Reserve

RESERVE OF AIR FORCE OFFICERS.

General Duties Branch.

The following Pilot Officers are promoted to the rank of Flying Officers on the dates stated:—(May 28, 1939) J. S Janby; (Sept. 8, 1939) P. E. Bressey, G. Crump, T. P. De La Rue, F. E. Everett, H. N. Gravenor, E. S. Hogg, K. C. Jackman, S. Le Rougetel, G. A. Pickett, R. L. Porteous, G. H. Porter.

F/O. I. W. Lowen is transferred to the Equipment Branch (Oct. 16, 1939); Wing Cdr. (Hon. Air Comdre.) J. B. Bowen, C.B.E., relinquishes his commission in class CC on cessation of duty (Sept. 1, 1939); Wing Cdr. R. E. M. Cherry, M.C., relinquishes his commission on cessation of duty (Dec. 6, 1939).

The following relinquish their commissions in class CC on appointment to commissions in the Royal Air Force Volunteer Reserve:—(Sept. 1, 1939) Sqn. Ldr. W. R. Warden, Flt. Lts. D. S. Jillings, M.B.E., M.C. (Sqn. Ldr. R.A.F., Ret.), R. Macfarlan, H. J. T. Russell, F. G. Saunders, M.C.

Flt. Lt. M. S. Shuldham-Legh relinquishes his commission in class CC on cessation of duty (Dec. 11, 1939); F/O. E. J. E. Burt relinquishes his commission on cessation of duty (Sept. 25, 1939). The notifications in the *Gazettes* of Oct. 20, 1939, Oct. 27, 1939, Nov. 21, 1939, Dec. 5, 1939, and Dec. 12, 1939, concerning Flt. Lts. L. S. Cundell, H. G. Morrell and J. H. Gurney, F. M. Rooth, W. Coker, D.F.C., and R. S. Martin respectively are cancelled.

Equipment Branch.

Acting Pilot Officer on probation J. Bayliss is graded as Pilot Officer on probation (Oct. 30, 1939).

Service Aviation

Royal Air Force Volunteer Reserve

General Duties Branch.

The following are granted commissions for the duration of hostilities in the ranks and on the dates stated. Pilot Officers on probation (Dec. 1, 1939) (seniority Nov. 6, 1939) Sgts. J. H. Bachmann, H. St. G. Bond, G. Haddon-Hall, R. H. Haviland, J. D. King; (Dec. 10, 1939) Sgt. D. L. Armitage, D. G. Ashton, J. D. Bisdee; (Dec. 17, 1939) J. H. L. Musker; (Dec. 24, 1939) Sgts. F. C. J. Butler, J. H. Harrison, A. L. Hedges, D. A. Hewitt, M. A. F. Hirst, P. S. Hirst, P. B. Hissey, F. H. Holmes, R. M. P. Jenkyns, P. L. Keeble, D. G. Lacey, J. Logsdail, C. D. N. Longley, P. R. D. A. C. Macdonald, C. C. McCarthy-Jones, R. G. Samuelson, R. J. Shellard, A. H. Stratford; (Jan. 2, 1940) V. J. Wheeler. Acting Pilot Officers on probation:—(Dec. 30, 1939) C. A. Bell, J. W. Chubb, D. E. I. Clark, J. C. Cowper, F. J. Drake-Carnell, R. G. Fennell, J. L. Gillespie, H. C. T. Graham, B. Green, J. Grocott, L. M. Hamilton, J. H. F. Hansen, C. J. F. Hare, P. H. Hazleman, G. F. Hogg, G. B. Houghton, C. Illingworth, R. M. Jamison, L. G. Johnson, F. W. Jourdeaux, T. H. N. Lane, A. E. Lovett, J. Lynch-White, J. G. Mackay, W. Mailer, C. T. Martin, D. H. Murphy, A. E. V. Oliver, J. C. Page, E. D. Pockney, H. Quittenden, L. C. J. Smith, W. F. Ward, L. W. J. Watt, R. G. M. Whigham, S. J. S. Wilde, J. Wilk.

Sgt. G. H. Pike is granted a commission for five years as Pilot Officer on probation with effect from Dec. 1, 1939, and with seniority of March 29, 1939; the commission of Acting Pilot Officer on probation S. H. Emerson is terminated on cessation of duty (Jan. 3), the notification in the *Gazette* of Nov. 14, 1939, concerning P/O. M. H. Seymour is cancelled.

Administrative and Special Duties Branch.

The following are granted commissions in the ranks stated with effect from Sept. 1, 1939, and with seniority of the dates stated. Squadron Leaders.—(April 17, 1939) Lt. Col. W. R. Warden (I.A., Ret.); (July 3, 1939) Flt. Lt. C. T. Johnson; (Sept. 1, 1939) Sqn. Ldr. D. S. Jillings, M.B.E., M.C., (R.A.F., Ret.). Flight Lieutenants.—(Oct. 1, 1939) Flt. Lt. H. J. T. Russell (R.A.F.O.); (Dec. 7, 1939) Flt. Lt. R. Maclarlan (R.A.F.O.); (Sept. 1, 1939) Maj. Y. R. D. Wigan, Sub. Lt. B. C. Morley, Flt. Lt. F. G. Saunders, M.C. (R.A.F.O.).

Sec. Lt. F. Pyle is granted a commission as Flight Lieutenant with effect from Sept. 1, 1939, and with seniority of May 27, 1937. (Substituted for notification in *Gazette* of Dec. 19, 1939.)

The following are granted commissions for the duration of hostilities in the ranks and on the dates stated. Pilot Officers on probation.—(Sept. 14, 1939) A/C. 2nd class H. H. Davidson; (Oct. 25, 1939) F. L. Clarke; (Nov. 4, 1939) C. Pidd; (Nov. 13, 1939) J. E. S. Long, L. W. Terry; (Nov. 7 1939) C. W. A. Dunning; (Nov. 20, 1939) J. E. A. Barton. The Rt. Hon. Lord W. G. H. W. Walerau; (Nov 23, 1939) P. Lamboit, J. F. Wright; (Nov. 29, 1939) F. A. Fyfe, M.C.; (Nov. 30, 1939) W. Ashton; (Dec 1, 1939) The Rt. Hon. Lord R. Cunliffe; (Dec. 2, 1939) A. L. Gates; (Dec. 4, 1939) R. B. Pearce; (Dec. 7 1939) H. Mundy; (Dec. 8, 1939) R. B. Viner; (Dec. 9, 1939) H. G. Boswell; (Dec. 10 1939) E. Drew, G. W. Hignett, W. E. F. Jennings, D. H. Johnson, S. Jones, C. C. Newton-Wade, J. Ree, C. Tinker, N. V. Webber; (Dec. 11, 1939) E. B. O'H. Bennett, I. Campbell-Bruce, H. Clarke, M. T. Cooper, C. B. Swann; (Dec. 12, 1939) H. Hulbert, M.B.E., G. N. C. Nicholls, W. B. van N. Wedd; (Dec. 13, 1939) J. F. L. Corkett; (Dec. 14, 1939) H. H. Michael, R. K. Morris; (Dec. 15, 1939) J. Alexander, C. A. A. Hiatt, J. C. Green, D.F.C., E. H. Stuart; (Dec. 18, 1939) R. Barrett, L. V. G. Barrow, L. S. Collard, Jai Singh, W. E. Windham; (Dec. 19, 1939) F. K. Huxham, G. D. F. Keddie, J. A. Prisley; (Dec. 20, 1939) N. S. Little, A. G. Pinkney; (Dec. 21, 1939) C. Refflit; (Dec. 22, 1939) H. J. Hart; (Dec. 25, 1939) H. J. Upward; (Dec. 27, 1939) M. S. Anthony, T. Bouch, G. W. Manton; (Dec. 28, 1939) E. J. Barrett; (Dec. 29, 1939) G. H. Brindley, T. C. Croll, J. McA. Goddard, J. C. Kilkenny, G. F. Orr, T. J. Whittaker, W. Winterbottom, R. A. Young; (Dec. 30, 1939) D. W. M. Prinsep, J. Uphill; (Jan. 1) G. De Gaye; (Jan. 9) E. T. Weddell, F. G. Carroll, B. N. Keeling, J. Macdonald. Acting Pilot Officers on probation.—(Dec. 18, 1939) J. F. Leeming; (Dec. 30, 1939) A/C. 2nd class G. P. Taylor.

K. J. G. Bartlett is granted a commission as Pilot Officer on probation (Aug. 25, 1939). (Substituted for notification in *Gazette* of Oct. 3, 1939.)

The following are granted commissions as Pilot Officers on probation on the dates stated.—(Aug. 24, 1939) T. C. Howland; (Aug. 26, 1939) W. J. Smith. (Substituted for notification in *Gazette* of Oct. 10, 1939.)

The following Flying Officers are promoted to the rank of Flight Lieutenant.—(Sept. 1, 1939) S. H. Bird, R. T. Colley.

The following Pilot Officers on probation are confirmed in their appointments and promoted to the rank of Flying Officer on the dates stated.—(June 25, 1939) P. G. Bacon; (Aug. 29, 1939) J. Moore; (Sept. 1, 1939) W. Ll. Thomas, T. A. Williams, M.C.; (Sept. 3, 1939) J. McLennan; (Sept. 7, 1939) D. W. Lane; (Sept. 8, 1939) J. F. Mellor; (Sept. 18, 1939) W. H. Mattinson; (Sept. 22, 1939) E. H. Irving; (Oct. 23, 1939) L. A. S. Harris; (Nov. 4, 1939) M. O. F. England, J. L. Finney, C. B. Millett, M. F. Poulter, J. H. Reynolds, M.M., G. H. B. Richards, D. S. Richardson, G. J. E. Smith, R. R. Thompson.

P/O. on probation C. G. Gilbert is confirmed in his appointment and promoted to the rank of Flying Officer (April 17, 1939). (Substituted for notification in *Gazette* of Nov. 21, 1939. F/O. A. D. McC. Blair takes rank and precedence as if his appointment as Flying Officer bore date Sept. 8, 1939. Reduction to take effect from Dec. 8, 1939; P/O. on probation G. E. Leaman resigns his commission (Jan. 12); the commission of P/O. on probation H. G. Boyle is terminated on cessation of duty (Dec. 24 1939); the notifications in the *Gazettes* of Oct. 20, 1939, Oct. 27, 1939, Nov. 21, 1939, and Dec. 5, 1939, concerning Flt. Lts. L. S. Cundell, H. G. Morrell and J. H. Gurney, F. M. Rooth, and W. Coker, respectively, and in the *Gazettes* of Sept. 26, 1939, and Oct. 3, 1939, concerning L. H. Peter and H. R. Patton, respectively, are cancelled.

Equipment Branch.

The following are granted commissions for the duration of hostilities in the ranks and on the dates stated:—Pilot Officer on probation: (Nov. 4, 1939) J. D. Christopher. Acting Pilot Officers on probation: (Oct. 24, 1939) M. H. Seymour; (Dec. 13, 1939) R. C. Woodland; (Dec. 20, 1939) R. P. Hewgill.

The following Acting Pilot Officers are graded at Pilot Officers on the dates stated:—(April 12, 1939) H. A. S. Gothard; (Sept. 5, 1939) H. E. Lewis; (Sept. 8, 1939) A. W. Low.

The following Acting Pilot Officers on probation are graded as Pilot Officers on probation on the dates stated:—(Nov. 9, 1939) E. G. Briggs; (Dec. 4, 1939) H. M. D. Davis, R. D. Mace, L. F. Weston; (Dec. 12, 1939) T. R. Williams; (Dec. 30, 1939) J. Beaton; (Jan. 4) R. R. Millais.

The commission of Acting Pilot Officer on probation W. J. R. Peacock is terminated on cessation of duty (Jan. 5).

Accountant Branch.

Payr. Lt. Cdr. C. J. Shaytor (R.N., Ret.) is granted a commission as Flight Lieutenant (Sept. 1, 1939).

Medical Branch.

The following are granted commissions for the duration of hostilities in the ranks stated (Dec. 12, 1939).—Squadron Leader: E. T. Cato, M.B., B.S., F.R.S.C. (Sqn. Ldr., R.A.A.F., Res.). Flying Officers: A. G. D. Gavin, M.C., M.R.C.S., L.R.C.P., P. A. Gimson, M.R.C.S., L.R.C.P., W. H. R. Jeremy, M.B., B.Chir., M.R.C.S., L.R.C.P., J. Watkins-Pitchford, M.B., B.S., M.R.C.S., L.R.C.P.

Meteorological Branch.

The following Acting Pilot Officers on probation are graded as Pilot Officers on probation on the dates stated:—(Nov. 20, 1939) J. A. Chaldecott, F. R. Ford, J. J. Higgins, H. F. T. Jarvis, D. C. Lloyd, N. B. Marshall, G. R. Mason, W. P. Osmond, L. H. Shave, T. H. Tyler, F. H. Lowe; (Nov. 21, 1939) A. J. Compton, L. G. Hall, L. Marchant, F. J. Phillips, P. T. Silley, B. O. F. Tott; (Nov. 22, 1939) M. W. Brown, R. C. Hocking, J. V. Meyer, E. J. Wenham; (Nov. 23, 1939) L. W. Carroll, G. J. Evans, V. Packer, H. G. Robinson, W. E. Tomkin; (Nov. 24, 1939) P. D. Bailey, J. Field, V. P. Kelly, J. E. E. McLaren, W. G. Moore; (Nov. 25, 1939) J. B. Leno; (Nov. 26, 1939) C. Crichton-Miller, J. R. Jenkins; (Nov. 27, 1939) L. J. M. Coleby, T. F. Davies, D. H. Follett, F. C. L. Littlejohns; (Nov. 29, 1939) G. H. Jones; (Dec. 4, 1939) G. E. G. Gibson, P. J. H. Green.

Chaplains Branch.

The Rev. G. Mayfield is granted a commission for the duration of hostilities with the relative rank of Squadron Leader (Dec. 11, 1939).

Auxiliary Air Force

General Duties Branch.

No. 907 (COUNTY OF MIDDLESEX) SQUADRON.—P/O. R. G. Percival resigns his commission (Nov. 7, 1939).

Accountant Branch.

No. 609 (WEST RIDING) SQUADRON.—P/O. A. G. Sudworth is transferred to the Administrative and Special Duties Branch (Nov. 17, 1939).

Women's Auxiliary Air Force

The following are appointed Assistant Section Officers:—(Jan. 6) Sgt. Miss J. D. McKay, Sgt. Mrs. M. G. MacLaran.

WHEELS DOWN, FLAPS DOWN, HOOK DOWN. A Blackburn Skua about to touch down on an aircraft carrier.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

ESCORT FIGHTERS

The "Heavy" Type Criticised

I WAS intrigued by Mr. King's informative article on escort fighters in *Flight* of January 11, 1940.

Although he does not definitely "go nap" on any one of the four main types discussed, by reason of his support for turrets and the faults found with range, field of fire, etc., of the single-seater and small two- or two-three-seater types, it would seem that he has a leaning towards the "escort heavy." This machine, which, to my mind, is a wrong approach to the problem, would defend itself and the bombers under escort by concentration of fire from four or more turrets—there being no need for unusual manœuvrability. Its speed would be a little in excess of the bomber's and the range about the same. Disadvantages as I see them are as follows :—

(1) Assuming a raid of ten bombers of the Wellington type escorted by ten "escort heavies," twenty machines will be subject to attack by the enemy. The ten machines must keep good formation in order to defend themselves and would be a better target for A.A. guns than would be ten bombers without escort. Admittedly, it might be found advisable to send over smaller numbers in each raid. An escort machine cannot defend itself against A.A. guns any better than a bomber. Carrying this point still further we are, in effect, uselessly exposing ten expensive machines to enemy A.A. guns.

(2) We can assume that however many machines are sent on a raid over enemy country, they will be out-numbered by at least two to one by defending fighters. (This may not be true if the raid were on a coastal town and of short duration.) Many enemy fighters will carry shell-guns, from which one direct hit may prove fatal, or will at least put a turret or two out of action, or an escort fighter. These latter must necessarily be complicated and turret gear in general will be very vulnerable. Added to this is the fear, which, I believe, has not yet been proved justified that the machine guns in the turrets will be out-ranged. No doubt our turret experts are working on shell-gun turrets. But I feel that these must still be some way off and I cannot at present think a free shell-gun could be as efficient as a fixed one, even if the difficulty of installation in a turret can be overcome without undue addition to turret weight and structural weight of the aircraft. I do not feel qualified to pass an opinion on the probable deflection of a "shell" fired at right angles to a machine flying at 250-300 m.p.h., if full use is to be made of the shell-gun's range.

Relative Losses

To return to the point: Will the relative losses of the enemy compared with those sustained by our machines show the "escort heavy" to be justified? I do not think so. The figures are more likely to be, say, two escort machines lost per six enemy single-seater fighters, allowing for A.A. guns taking their toll. Eight of our raid of ten bombers might be lucky enough to get home and, say, four escort machines. Losses—eight large machines and approximately forty men, as against twenty-four enemy fighters and twenty-four men. Even if the enemy lose forty men and machines, I believe they can produce five single-seater fighters while we put through one escort heavy with its two or more engines and four-five turrets. At any rate, if there is any doubt on this score, the escort is not justified, as, presumably, at least some of our losses would occur before the objective was reached. The escort must at least enable us to reduce our losses below those of the enemy.

Considering again what are usually called round figures, 1,000 bombers with an average life of five raids would be better than 500 with a life of ten raids and 500 escort machines with a similar life. The aircraft losses would be the same and the bomb load carried the same, but twice the number of raids and twice the time would be required. We here assume that 1,000 large machines of any sort is our best production for, say, one month, and that armed bombers and escort heavies are a similar proposition for production. If it is argued that my loss figures are too pessimistic, I point out that there is still a 50 per cent. time or raid margin.

(3). If a bombing attack at low altitude is contemplated, escort machines again lose much of their value in that they cannot well help a bomber against attack from machine guns and other light guns or from the pom poms on warships. Surprise is about the only "defence" for the occasions.

It would be cowardly to criticise without making a suggestion and although there are many more questions which have a bearing on types of escort machines and their uses, this letter would reach the proportions of a small book if one tried to discuss them all. Let me therefore say that in the light of our present knowledge (this excepts those few experts in the "real know") I feel that we can do no better than continue with later types of bombers of a type similar to those in service. Speeds will soon be in the region of 300 m.p.h. A slight increase in armament, which, I agree, must include three to four turrets; increased protection for crew, in particular the rear gunner, and we shall have a very formidable offensive and defensive weapon. These are very modest demands. With two engines of 1,500 h.p. to 2,000 h.p. and an aircraft no bigger than our Wellington we could comfortably carry four turrets and an effective bomb load at a top speed of 320 m.p.h. for a range of 3,000 miles.

Germany was right in keeping her bombers small though it appears that speed and manœuvrability rather than plenty of defensive armament may prove very expensive in machines and men in view of our Spitfire and Hurricane exploits.

A suggestion which I feel bound to mention and which I had the pleasure of discussing with Mr. King some months ago concerns the possibility of remote controlled turrets. Briefly, if the rear gunner, to take the example of the most exposed man, could control his turret from a protected position somewhere amidships, his job would be safer and could be carried out under improved conditions—and therefore, in all probability, with improved efficiency. The aerodynamic form of the aircraft tail would be greatly improved and the turret control less vulnerable. The real problem in this connection would seem to be the sighting of the guns. This does not appear by any means insurmountable. The single controls need not necessarily operate one turret only, although in view of the different fields of fire normally to be covered by each turret, the control of only one turret at a time would be the usual practice.

"THEORIST."

London, N.W.

Two Fighters to One Bomber

I HAVE been following with great attention your articles on modern military aircraft. The last one [We hope not.—ED.] which appeared in *Flight* of January 11, is particularly interesting.

I am in full agreement with your ideas on escort fighters; I would go even further and suggest that every bomber on a long-range raid needs an escort of two fighters. You will find that this is the ratio adopted by Franco's air force during the Spanish civil war.

As far as your layouts are concerned, the turret twin-engined aircraft does not really appeal to me, not because of the turret, but on account of its rather limited sector of fire in the most important direction, i.e., along the tail of the machine. Moreover, I do not see how you are going to overcome the difficulties of installing, say, two shell-guns in a turret, without exceeding limits imposed by drag and weight.

Another difficulty will be the recoil when firing at a considerable angle to the line of flight of the aircraft.

I am afraid you cannot rely on machine guns only, as any fighter equipped with efficient "cannons" on a semi-mobile mounting, will shoot the convoy aircraft to pieces, without even attempting to enter the zone covered by the cross-fire of escorting flights. Thus I think you will agree with me that the convoy fighter must necessarily be armed with shell-guns.

On the other hand, if you adopt the two-to-one fighter-bomber ratio alluded to above, you will find that the importance of heavy tail armament becomes less pronounced.

An excessive use of "formation tactics" may lead us back to the old "Douhet" Flying Fortress and make it reappear in the new guise of multi-seat turret fighter.

I feel that we must now think in terms of 450 miles per hour, and therefore I would rather rely on the simultaneous manœuvres of two destroyers, than on a rigid formation of turret fighters. A system of "dynamic" defence must now be studied to replace the old-fashioned conception of "static" defence based on fire zones, imitated from operations on land.

Present-day information on the results of various aerial combats is still very vague, unconvincing and unreliable. With all due respect, the turret is only a survival of the past, and sooner or later will degenerate into a "power-operated restricted-field mounting." Incidentally I have heard rumours

of the latter system being tried out on the Continent.

As soon as the shell-gun achieves the necessary range and accuracy of fire, "zone defence" by machine guns will become obsolete, and new means will have to be devised to protect bombers. Anti-aircraft bombing will probably give the *coup de grâce* to present-day defence formation tactics.

"TACTICIAN."

Twin Engines and Contra-props

I AM very interested in your article on escort fighters. May I suggest the following specification?

Twin engines mounted one behind the other in the fuselage, driving coatra-props (two engines for a reasonable factor of safety and a separate drive to each prop, *not* one large engine. The aerodynamic advantages are obvious).

Give the pilot two guns mounted in the wings, just in case his gunners get "shot up," and also in case an enemy aircraft is foolhardy enough to fly across his "bows" (why throw away opportunities?).

Mount a power-driven retractable turret halfway down the fuselage in the usual manner.

And also a power-driven tail turret (aerodynamic losses are more than paid for by the greater protection and fire power).

Fuel for 1,500-2,000 miles.

Summary: Smallest possible aircraft with the greatest possible range, speed and fire power.

I think you will agree that to attack a "small" fighter of this type would be a very unhealthy proposition.

It would be larger than a Defiant and smaller than a Blenheim, and a better fighter than either of them.

Speed? Well, use your imagination.

It should not take long to adapt Merlins to contra-prop use or to produce the airscrews if the A.M. would give the word; the problems involved are not formidable and consist to a large extent of rearrangement of parts.

Here are two concrete cases for you to work out for yourselves.

How much speed would, say, a Blenheim gain if its nacelles were removed and the wing span reduced accordingly?

And how much speed would, say, a Spitfire gain with twin Merlins and contra-props and its wing area increased to take the extra load?

COLIN R. BARTY.

Southampton.

The Author Replies

"THEORIST" opens his long argument with an unwarranted assumption which disqualifies for discussion the first part of his letter. I deliberately refrained from mentioning the optimum fighter-bomber ratio, confining myself to an examination of possible aircraft types. Frankly, I visualised no hard and fast numerical ratio; this, of course, would depend on the importance of the mission and the opposition expected. Certainly I had not in mind a fifty-fifty ratio for normal operations. Rather I foresaw a sprinkling of what Mr. Armstrong conveniently calls "escort heavies" (someone else has aptly termed them "the back row of the scrum") to strengthen the fire-power of the formation.

It is obvious that the larger the formation the more vulnerable it is to anti-aircraft guns and A.A. bombs. Likewise it is reasonable to argue that the enemy fighters will be using shell-guns. It is also true, however, that while A.A. guns are firing, the main enemy fighter force will be handicapped and the bombers may adopt a special formation. The smaller type of fast two-three-seater escort fighter with a single turret would be useful for shooting down enemy fighters which attempted to drop A.A. bombs on the bombers.

Regarding the calibre of guns, the writer is quite aware of the difficulties attaching to the design of turrets for shell-guns but in the absence of publishable information is inclined to believe that these have proved by no means insurmountable. In any case the largest guns have so far been installed on big multi-engined machines.

I agree that the escort machines can do little or nothing to help low-flying bombers when attacked by anti-aircraft guns, but I do not agree with Mr. Armstrong that this means they "lose much of their value." One might as well argue that a Sunderland convoying merchantmen loses much of its value because it cannot guarantee immunity against magnetic mines.

"Tactician" does not make himself clear when he states that the twin-engined turret aircraft does not appeal to him on account of its rather limited sector of fire in the most important direction, i.e., along the tail. A turret in the extreme tail has as wide a sector of fire as could possibly be required in view of the fact that there are other turrets further forward, firing above and below the fuselage. Although the "super-Hampden" proposal illustrated in the article has no tail turret, the top and bottom turrets firing above and below a very slim tail boom offer complete tail protection.

With regard to "Tactician's" proposals for "dynamic defence," I simply will not believe that a heavily loaded long-range twin-engined fighter can take on, with a reasonable chance of success, one or (more likely) several, lightly-loaded but heavily armed defending machines. These will triumph because of their superior manœuvrability, which will render quite ineffective the fixed or semi-fixed armament of the escort machines. To take the best possible example we only have to imagine an escorting Messerschmitt Me 110 against one, two or three Hurricanes or Spitfires. The majority of the Me's armament is fixed, and with its high wing loading the machine would, I venture to suggest, be little more effective than, say, a Do 17. In its present form it is a good long-range fighter for intercepting bombers, but a poor escort machine for attacking fighters. With a Defiant-type turret, of course, it would be a different proposition. In fact, it might become a very good escort fighter indeed.

To summarise, I maintain that long-range escort fighters should be designed for strengthening the defensive fire-power of the bomber force (to which end they must have turrets) and not for attempting to dog-fight, at a great numerical and technical disadvantage, with local-defence intercepters.

Short-range work is, of course, another matter. If the bombers are to penetrate only a short distance into enemy territory and will not be long over dangerous country, a protective force of single-seaters will be a very great advantage, as demonstrated in Japan and Spain.

H. F. K.

AN EARLY AVRO

Some Reminiscences

THE interesting controversy in *Flight* relating to statements in Sir A. V. Roe's book, "The World of Wings and Things," is becoming acrimonious, as opinions on such-like debatable subjects mostly do. It may interest some readers (who may not have read the book in question) to know that the little craft Sir Alliot built in 1907 (his second effort) was equipped with an 8 h.p. air-cooled J.A.P. motor cycle engine. Concerning this machine an article was published in *The Motor Cycle* of May 16, 1908, in which the writer said: "The machine was constructed of various odds and ends, portions of a superannuated pedal cycle playing a prominent part in the make-up. This was not the sort of power unit that one would have selected for so momentous an experiment, but, like most of the pioneers, young Roe was woefully handicapped by lack of cash, and in the face of much scepticism it was practically impossible to secure capital for work of this kind. In the autumn of 1907 this little bus was run out on Lea Marshes, that desolate tract of land in the north of London, an abode of stray cats, tomato tins and ash heaps. The machine indubitably flew, though its progress was erratic, to say the least of it. The authorities, enraged at this literal flying in the face of Providence, forbade further experiments here on the ground that the grass was being spoilt for grazing!"

Sir Alliot's further experiments are probably better known than the story of his very earliest struggles, which, like the trials and tribulations of all pioneering, is more interesting than the disputes which often follow in later days.

A. F. J.

Harrow.

YOUTHFUL CONFIDENCE

From Glider to Tiger Moth

IN view of the discussion about the value of gliding taking place at the present time, I feel that the opinion of one of the younger gliding pilots may be of interest. I am 16 years of age and obtained my "C" certificate when I was 15 years old.

After 40 hours' solo flying I am confident that after a few circuits with an instructor in, say, a Tiger Moth, I should feel no qualms about going solo. I am also of opinion that I know more about the air than most power pilots of several hundred hours' experience. In my 40 hours I have had two landings in strange fields (both successful), and my friend, who is six months younger than myself, and I, are both considered safe pilots in spite of the supposed impetuosity of youth.

Many flying people think that youths who learn to fly when they are about 15 years old make the best pilots, and according to the existing regulations the only way to get this tuition is to learn to fly motorless aircraft.

DUNCAN SWALE.

Gt. Hucklow.